



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Original Research

Public health information on COVID-19 for international travellers: lessons learned from a mixed-method evaluation



T. Zhang ^a, C. Robin ^{b, c, d, e}, S. Cai ^a, C. Sawyer ^{f, g}, W. Rice ^b, L.E. Smith ^{h, i}, R. Amlôt ^{c, i, j}, G.J. Rubin ^{h, i}, R. Reynolds ^{a, c}, L. Yardley ^{c, k, l}, M. Hickman ^{a, c}, I. Oliver ^{a, b, c}, H. Lambert ^{a, c, *}

^a Population Health Sciences, Bristol Medical School, University of Bristol, Bristol, UK

^b Field Epidemiology, Field Service, National Infection Service, Public Health England, Bristol, UK

^c NIHR Health Protection Research Unit in Behavioural Science and Evaluation, Bristol Medical School, University of Bristol, Bristol, UK

^d NIHR Health Protection Research Unit in Emerging and Zoonotic Infections, University of Liverpool, Liverpool, UK

^e NIHR Health Protection Research Unit in Gastrointestinal Infections, University of Liverpool, Liverpool, UK

^f UK Field Epidemiology Training Programme, Global Public Health Division, Public Health England, London, UK

^g Communicable Disease Surveillance Centre, Public Health Wales, Cardiff, UK

^h Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK

ⁱ NIHR Health Protection Research Unit in Emergency Preparedness and Response, King's College London, London, UK

^j Behavioural Science Team, Emergency Response Department Science and Technology, Public Health England, UK

^k School of Psychological Sciences, University of Bristol, Bristol, UK

^l Department of Psychology, University of Southampton, Southampton, UK

ARTICLE INFO

Article history:

Received 27 October 2020

Received in revised form

22 January 2021

Accepted 25 January 2021

Available online 10 February 2021

Keywords:

COVID-19

Public health advice

Government

Policy

Airport

International travel

ABSTRACT

Objectives: In the containment phase of the response to the COVID-19 outbreak, Public Health England (PHE) delivered advice to travellers arriving at major UK ports. We aimed to rapidly evaluate the impact and effectiveness of these communication materials for passengers in the early stages of the pandemic. **Study design:** The study design used is the mixed-methods evaluation.

Methods: A questionnaire survey and follow-up interviews with passengers arriving at London Heathrow Airport on scheduled flights from China and Singapore. The survey assessed passengers' knowledge of symptoms, actions to take, and attitudes towards PHE COVID-19 public health information; interviews explored their views of official public health information and self-isolation.

Results: One hundred and twenty-one passengers participated in the survey and 15 in follow-up interviews. Eighty three percentage of surveyed passengers correctly identified all three COVID-19 associated symptoms listed in PHE information at that time. Most could identify the recommended actions and found the advice understandable and trustworthy. Interviews revealed that passengers shared concerns about the lack of wider official action, and that passengers' knowledge had been acquired elsewhere as much from PHE. Respondents also noted their own agency in choosing to self-isolate, partially as a self-protective measure.

Conclusion: PHE COVID-19 public health information was perceived as clear and acceptable, but we found that passengers acquired knowledge from various sources and they saw the provision of information alone on arrival as an insufficient official response. Our study provides fresh insights into the importance of taking greater account of diverse information sources and of the need for public assurance in creating public health information materials to address global health threats.

© 2021 The Authors. Published by Elsevier Ltd on behalf of The Royal Society for Public Health. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

* Corresponding author. Population Health Sciences, Bristol Medical School, University of Bristol, Bristol, UK. Tel.: +44(0)117 9096406.

E-mail address: h.lambert@bristol.ac.uk (H. Lambert).

Introduction

With international arrivals growing to 1.186 billion in 2015,¹ increasing global connectivity has increased pressure on cross-national prevention and containment of disease outbreaks, including the COVID-19 pandemic. Recent studies show a central role of travel in the spread of COVID-19, with evidence of a strong correlation between domestic travellers departing from Wuhan and the subsequent seeding of COVID-19 epidemics in their arrival cities.² Internationally, the countries receiving the largest traveller volumes from Wuhan, such as Thailand and Japan, also confirmed the highest COVID-19 cases outside China in January 2020,³ along with certain in-flight COVID-19 transmission cases reported worldwide.⁴ The first cases of COVID-19 in England were reported on 29th January in two recently arrived travellers from China. Initial cases were mostly associated with international travel.

The ongoing risk associated with travel highlights the importance of interventions that target arriving passengers to control transmission and protect the public. During the containment phase of the UK's COVID-19 response, whereas the outbreak epicentre was in Asia, public health information was delivered to travellers arriving at UK ports (summarised in [Box 1](#)).

Box 1

Summary of measures at UK ports for arriving travellers since containment phase of the COVID-19 response.

- The Airport Public Health Monitoring Operations Centre established by Public Health England (PHE) was activated on 25th January to monitor all direct flights from China to LHR, and operations were extended to include all direct flights to London Gatwick and Manchester on 29th January until travel restrictions were implemented.
- Measures directed at passengers travelling from affected countries into the UK included a broadcast message to passengers made on incoming aircraft, to encourage travellers to report their illness; posters containing COVID-19-related public health advice displayed at these three airports; and leaflets containing this advice provided to passengers by airlines on board the flight and/or made available on arrival.
- Contact tracing was undertaken when a case was reporting including flights and other transport.
- Since 8th June, people entering or return to the UK are required to provide their journey and contact details and self-isolate for 14 days if arriving from an affected country, with penalties of up to £1000 for breaking this rule.⁵ These regulations continue to be amended, with exemptions for travellers arriving from specified countries of origin.

Provision of public health advice at ports of entry was last used in the UK in during the 2014/2015 Ebola outbreak in West Africa, and travellers considered this reassuring.⁶ Emerging viral diseases, such as Ebola, have caused widespread panic and travel warnings; however, COVID-19 has more serious impact on travel medicine and tourism industry than Ebola and other public health emergencies of international concern.⁷ This study aimed to evaluate the effectiveness and impact of Public Health England (PHE) COVID-19 communication materials (see Supplementary documents) for

passengers arriving at UK airports during the containment phase of the response (24th January–12th March). The study was conducted at the request of the Department of Health and Social Care via the National Institute of Health Research. Adjustments to the study protocol were made due to the fast-changing situation as the number of flights carrying passengers into the UK dropped substantially in the monitoring period, from 16 to 18 flights daily from China (including Hong Kong) into London Heathrow (LHR) in the third week of January to nine flights per week by the end of January, reducing further in subsequent months. Internal LHR data indicate that in March, 123 flights arrived from China, Hong Kong and Singapore, one-fifth of the number in February.

Methods

We undertook a two-stage mixed-methods evaluation, starting with patient and public involvement interviews with Chinese students and staff at two UK universities returned to the UK from China in January and February 2020 (stage I), followed by a survey and semistructured interviews with air passengers returning to the UK from COVID-19 affected countries (stage II). The questionnaire and interview topic guides developed for stage II were based on stage I results. This article only reports findings from stage II.

Study population

Returning travellers aged 18 years and older from any nationality, arriving into LHR airport from affected countries after PHE leaflets and posters began to be distributed on 23rd January.

Sampling and methods

Cross-sectional survey

Passengers arriving at LHR airport on three scheduled flights on 4th March from Singapore and on 12th March and 13th March from China were recruited into the survey. PHE listed both countries as places of origin necessitating advice for travellers, with Hubei and Wuhan in China highlighted as requiring separate advice. Paper questionnaires in English, Mandarin and Cantonese, along with the PHE leaflets in English and simplified Chinese script, were issued by airline crew (who were given instructions in advance) to all passengers for completion before disembarkation. The short questionnaire collected information on: participants' knowledge of COVID-19 symptoms (Q1) and help-seeking behaviours (Q2); whether participants received the public health advice (Q3) and views on it (Q4); and demographic information (Q5–Q11).

Respondents were also invited to record their name and contact details if willing to take part in follow-up interviews. Researchers then met passengers at disembarkation points at LHR airport to collect completed questionnaires and consent passengers to follow-up interviews.

Semi-structured interviews

Passengers consenting to interview were contacted by email to confirm an interview time and language preference (English/Mandarin). After confirmation, one-to-one telephone interviews of approximately 30 min were conducted between 2nd–23rd April 2020.

During interviews, participants were asked about the COVID-19 information they received during their journey and their thoughts on the PHE information provided. Interviewees who reported having developed symptoms since arriving in the UK and had self-isolated were also asked about their views and experiences of self-isolation, using a separate topic guide.

All interviews were audio-recorded, and researchers created summaries of each interview. English interviews were transcribed *verbatim*; Mandarin interviews were transcribed directly into English.

Data analysis

Categorical data were described as proportions and continuous data as median with interquartile range (IQR). All analyses were conducted in Stata v15.1 (2017, StataCorp LLC, College Station, TX).

Interview transcripts were coded using open coding. An initial coding framework was collaboratively developed by four researchers (T.Z., S.C., C.S., W.R.) each coding one interview that they had conducted. Two (T.Z., S.C.) of the research team used the coding framework to index each transcript in NVivo 12 Pro. Coding was performed iteratively within and between transcripts; common categories emerged across the transcripts, indicating data saturation.⁸

Results

Survey results

Demographic characteristics

One hundred twenty-one completed questionnaires from passengers on three flights were collected. Of those who answered (n = 117), the age range was 20–81 years (median: 53, IQR: 36–64 years); 48 of 120 (40.0%) were male and 72 of 120 (60.0%) female. Just over half of respondents were British (n = 64/118; 54.2%), 25.4% (n = 30/118) were Chinese and 20.3% (n = 24/118) were ‘Other’. Most respondents could read English fluently (n = 99/118; 84.0%), 14 were bilingual and four trilingual. Seventeen (14.4%) could only read Mandarin and 1 (1.0%) could only read Cantonese. None of the respondents had been to Wuhan city in mainland China in the 14 days before arriving at LHR.

Knowledge of symptoms and actions to take

Most respondents correctly identified a fever/high temperature (87.6%), difficulty breathing (87.6%) and cough (85.1%) as the symptoms associated with COVID-19 (Table 1). In line with the official case definition at the time (described in PHE leaflets as cough, fever or shortness of breath), 101 (83%) of 121 respondents identified all three symptoms as symptoms of COVID-19.

Most participants were correctly aware that people with COVID-19 might not show symptoms immediately (77.1%) and that

asymptomatic status could last for 14 days (75.4%). Of all participants, 92.4% of participants also thought that people with COVID-19 can be contagious even without symptoms. A minority of respondents (9.3%) mistakenly thought antibiotics could treat COVID-19, and a substantial proportion (27.1%) were uncertain.

Table 2 shows that most passengers were able to identify the recommended actions to take if they had been to Wuhan in the previous 14 days – to self-isolate (96.6%) and call NHS 111 for advice (84.6%). Respondents were less confident about actions to take for those who had visited other named destinations; among people who had travelled to Singapore in the past 14 days, most correctly stated that they should not take any action if well, in accordance with PHE information, but a substantial minority thought they should self-isolate (23.7%) and call NHS 111 for advice (18.8%), respectively, whereas the PHE leaflets advised these actions only for those with symptoms.

Attitudes to official advice

One hundred four of 121 (86.0%) passengers stated that they had read the leaflet (94 read the English version, 30 read the Mandarin version and 20 read it in both languages). Only 6 (5.0%) stated that they had not read it in either language.

Overall, respondents thought the leaflet and poster (leaflets distributed in flight had the same content as leaflets and posters displayed at the airport) were easy to understand (84.4% agree or strongly agree) and trustworthy (84.2% agree or strongly agree). Most respondents also agreed that they had received sufficient information on what to do in response to COVID-19 symptoms, including how and when to avoid contact with others (Table 3).

Qualitative findings

Fifteen interviews were conducted; five men and 10 women with ages ranging from 21 years to older than 80 years. Six were retired, five worked full-time, three were full-time students and one was unemployed. Most participants were permanent residents in the UK; three were limited-duration residents and two were temporary visitors. Most (11 participants) were British, three were Chinese, and one was from New Zealand. All Chinese participants could speak Mandarin and English and had seen PHE information in both languages. All White participants could speak only English.

The results represent passengers’ views and perspectives on the public health advice and their experiences of self-isolation. These views clustered into five broad themes (Table 4). Only themes

Table 1
Recognition of COVID-19 symptoms in a sample of 121 passengers arriving at London Heathrow airport from COVID-19 affected countries between 4th and 13th March, 2020.

Symptom	Yes N (%)	No N (%)
Symptoms listed in PHE information		
Fever/high temperature	106 (87.6)	14 (11.6)
Difficulty breathing	106 (87.6)	14 (11.6)
Cough	103 (85.1)	18 (14.9)
Symptoms not listed in the PHE information		
Fatigue or tiredness	70 (57.9)	48 (39.7)
Sore throat	64 (52.9)	51 (42.2)
Sneezing	60 (49.6)	56 (46.3)
Runny nose	55 (45.5)	62 (51.2)
Chills/shivering	54 (44.6)	59 (48.8)
Aches or pains in your muscles, joints or bones	53 (43.8)	61 (50.4)
Headache	50 (41.3)	65 (53.7)
Loss of appetite	38 (31.4)	73 (60.3)
Nausea/vomiting	32 (26.5)	83 (68.6)
Diarrhoea	30 (24.8)	86 (71.1)
Stomach ache	14 (11.6)	100 (82.6)

Note: Percentages in Table 1 treat ‘missing’ as another group since ‘Not sure’ was not an option offered for this question.

Table 2
Knowledge of health-seeking behaviour in a sample of 121 passengers arriving at London Heathrow airport from COVID-19–affected countries between 4th and 13th March, 2020.

Statement	True N (%)	False N (%)	Not sure N (%)
Statement advised in PHE information			
If someone arriving in the UK has been to Wuhan in mainland China in the past 14 days, they should stay indoors and avoid contact with others	114 (96.6)	3 (2.5)	1 (0.9)
If someone arriving in the UK has been to Wuhan in mainland China in the past 14 days, they should call NHS 111 for advice	99 (84.6)	12 (10.3)	6 (5.1)
Statement not advised in PHE information			
If someone arriving in the UK has been to Singapore in the past 14 days, they should stay indoors and avoid contact with others	28 (23.7)	75 (63.6)	15 (12.7)
If someone arriving in the UK has been to Singapore in the past 14 days, they should call NHS 111 for advice	22 (18.8)	80 (68.4)	15 (12.8)

Note: Percentages are for those who responded to the statement.

Table 3
Attitudes to official Public Health England advice in a sample of 104 passengers arriving at London Heathrow airport from COVID-19–affected countries between 4th and 13th March, 2020.

Statement	Strongly disagree N (%)	Mostly disagree N (%)	Mostly agree N (%)	Strongly agree N (%)
The leaflet and poster at the UK airport were easy to understand	10 (10.4)	5 (5.2)	36 (37.5)	45 (46.9)
The leaflet and poster at the UK airport can be trusted	11 (11.6)	4 (4.2)	36 (37.9)	44 (46.3)
I have received enough information about what to do if I develop symptoms of coronavirus	13 (12.2)	4 (3.7)	35 (32.7)	55 (51.4)
I have received enough information about how and when to avoid contact with other people	12 (11.1)	5 (4.6)	44 (40.7)	47 (43.5)

Note: Percentages are for those who responded to the statement.

relating directly to the reception of public health advice are reported below.

Knowledge of symptoms and actions to take if symptomatic

Thirteen of 15 participants recalled receiving the information leaflet during the flight or at the airport in Singapore or China. Most were impressed with the information and measures being taken at departure airports and surprised that ‘there was almost nothing’ [participant 11] and ‘nobody seemed to care’ [participant 8] on arrival at LHR. Only three passengers saw posters, which they said were not eye-catching (Table 5, quote 1; Fig. 1).

Cough, fever/high temperature and, progressively, breathing difficulties were the most frequently mentioned symptoms; ‘you may be asymptomatic and so you have a cough or you might come down with a full-blown fever to the point where really you cannot breathe’ [participant 1]. Many passengers associated other diverse symptoms such as headache, fatigue, loss of smell and taste with COVID-19 although they were not included in the official case definition at the time.

Most participants said they would start with self-isolation when symptoms were mild and call NHS 111 if symptoms progress, indicating they would follow official advice and base their actions on disease severity (Table 5, quote 2).

Attitudes to official advice

The content of UK official advice was considered reasonable and adequate; passengers commented that it was ‘quite clear and

sensible’ [participant 5] and felt the government was taking some action in response to the outbreak.

Participants commonly mentioned concerns that people in the UK may disregard official advice, citing their lived experience in affected countries where televised public health information for COVID-19, including on social distancing and washing your hands, was ‘reinforced every time there was a commercial break’, whereas in the UK ‘it’s random’ [participant 2]. They noted that the lack of visible pandemic control measures at LHR gave ‘a false sense of security’ [participant 7] and suggested reinforcing official measures such as installing temperature scanners, handing out materials and increasing number of personnel at airports, as well as enacting compulsory regulations to limit close contact and quarantine arrivals (Table 5, quotes 3 and 4).

Acting on official advice

Most participants had acquired information from both the UK and countries of departure, regardless of their usual country of residence. Since COVID-19 had already spread in the countries where travel originated, participants considered they were ‘educated enough about it’ [participant 7] and treated it more seriously than the UK population; they were, as one participant put it, ‘a bit ahead of the game’ [participant 3]. On arrival in the UK, as a precaution many participants voluntarily self-isolated or tried to distance themselves and avoided activities where people would be gathering, although this was not officially advised at that time (Table 5, quotes 5 and 6).

Table 4
Themes and subthemes related to passengers’ views on public health advice and self-isolation.

Themes	Subthemes
Understandings related to COVID-19	COVID-19 knowledge/personal or lived experience/exposure/domestic concerns/personal protective equipment
Attitudes towards information materials and presence, self-isolation and lockdown	Attitudes on advice, information and presence/attitudes on self-isolation and lockdown/public adherence and perceptions of other/social pressure
Practices and experience during the pandemic	Difficulties/feeling lucky/self-disciplinary/compulsory measures
Information and advice	UK official advice/other source information/clear/reliability
Support	Emotional support/healthcare support/information support/instrumental support

Participants expressed awareness of their exposure risk while travelling that led some of them to self-isolate (see Table 5, quotes 7–9). They further noted that by doing so, they would avoid blame if any of their loved ones did get sick; one said they knew there was likely to be a ‘stigma’ around them having come from an affected country [participant 10].

Despite experiencing some mental pressure, participants expressed feeling fortunate to have the physical and social resources to manage their self-isolation effectively, while being aware that this was not the case for everyone (Table 5, quote 10).

The reasonable and clear official information was seen to shape public understanding of the COVID-19 crisis and therefore as promoting public acceptance of official advice (Table 5, quote 11). Participants further emphasised the crucial role of community support; ‘I think providing they have sufficient support in their communities there is no reason at all why anybody should not self-isolate’ [participant 9].

Differences between Chinese and British passengers

Regarding advice about calling NHS 111, Chinese respondents shared more concerns than British respondents, including difficulties in getting through to an advisor, the vagueness of advice itself and uncertainty about whether NHS support is available for non-citizens. Alongside calling NHS 111, while some British respondents noted contacting their GP as a potential source of advice, Chinese respondents relied more on personal/social networks, such as teachers or supervisors (Table 5, quote 12). Chinese passengers further noted that, compared with China, people in the UK follow advice on an entirely voluntary basis. One Chinese respondent suggested that ‘self-isolation must be compulsory’ [participant 15]; otherwise it will not be universally enacted by the public even if the advice itself is good.

Chinese passengers and British passengers have contradictory views on wearing face masks. Chinese respondents suggested to add wearing masks into UK official advice and despite their awareness of cultural and policy differences, emphasised their concerns that staff at the airport did not wear masks (Table 5, quote 13). Conversely, the majority British respondents noted their lack of conviction in the use of masks due to the absence of clear evidence (Table 5, quote 14). Some were actively opposed to the use of masks because ‘they could do more harm than good’ [participant 3].

Discussion

Our findings show that passengers arriving from China and Singapore in the containment phase of the COVID-19 pandemic found the content of official public health information from PHE to be clear and easy to understand. Most correctly identified the actions to be taken when becoming symptomatic or arriving from certain destinations and considered this advice to be acceptable and trustworthy. However, there was some uncertainty regarding whether those arriving from a country or territory listed in PHE information other than Hubei or Wuhan should self-isolate or call the NHS helpline. Most of those surveyed (83%) correctly identified all three symptoms described in the leaflets and poster, but over half those surveyed and many of those interviewed also identified fatigue and sore throat as symptoms, with substantial proportions identifying other symptoms not included in the official case definition during the evaluation period. This definition changed over time alongside evolving scientific knowledge of the virus, and some symptoms identified by respondents have since been recognised as common manifestations of COVID-19, including anosmia which is now included in the official case definition. Because these passengers were arriving from countries where COVID-19 had spread

Table 5
Passengers’ views and perspectives on public health advice (illustrative quotes).

Number	Quotes
1	‘I walked fast passing (those leaflets/posters), didn’t pay much attention.’ [participant 15]
2	‘Well the first thing I would have had to do would be to self-isolate. ... And if the symptoms obviously got progressively worse I would then either contact my GP or phone 111. But it’s a fairly straightforward process that’s been set up to do this’. [participant 9]
3	‘At Heathrow, we arrived and it was like nothing was wrong in the UK, so I think that causes a false sense of security, so maybe if there was more of a presence, like information, temperature check, personnel etc, people might take it more seriously.’ [participant 5]
4	‘Well they could have had thermal imaging cameras, they could have had medical staff in protective clothing there to talk to people whose temperature came up as above the norm, they could have then asked people in those conditions, you know, if they met those conditions to isolate them, you know.’ [participant 8]
5	‘... even though there wasn’t the, you know, that wasn’t really about the distancing over here, but we just thought we won’t see family and friends for some time just because we’d been or gone through Singapore.’ [participant 3]
6	‘I didn’t dare go to the university to take the exam on Monday, because the teacher said if you didn’t feel well you could stay at home and didn’t have to go to the university to take the exam.’ [participant 13]
7	‘... but being on the plane with other people coming from who knows where with who knows what, you know, we were a bit more concerned which is why we isolated when we came home.’ [participant 11]
8	‘We didn’t want to put any of our family members or friends at risk in case we were carrying the virus but didn’t know it.’ [participant 2]
9	‘... we sort of knew pretty much that the chances of us giving him (family member) anything were miniscule, because we wouldn’t have put anybody at risk if we really thought that there was a chance but we just didn’t want it on us.’ [participant 3]
10	‘I can’t think about it, I have to think about we’re very lucky, we’re luckier than most and if I want to go down and walk along the beach I sort of can. ... I think if somebody is locked up in a one-bedroom flat in London it will be horrible, it must be horrible for them ...’ [participant 10]
11	‘I can’t think why you would not follow the official advice but I think the mere ... at the time the number of people who had died from Coronavirus it was rising but I think ... and the numbers were unclear, but they were talking about one to two percent of the people who got infected may die ...’ [Ppparticipant 1]
12	‘Someone told me it [NHS 111] is constantly engaged ... I would have hoped to know how to contact the NHS effectively in the case that I was infected. At that time, one could not get through to the NHS helpline. Maybe I could have been given a few more telephone numbers? This kind of information enabling me to have access to medical treatment would have given me a sense of security.’ [participant 15]
13	‘They [airport staff at customs] told us to take our face masks off. I understood their request. But the staff there didn’t wear face masks. ... As far as face masks are concerned, it is said that perhaps the virus will spread faster when face masks are not worn.’ [participant 14]
14	‘... and there wasn’t any clear evidence to say a mask, an ordinary mask would prevent you picking up germs and if you did pick up a germ it would multiply inside the mask. So even though we had masks in our bags ... so we had everything with us but we decided we’d use the hand gel but we didn’t want to wear the masks.’ [participant 8]

further than in England when the study was conducted,^{9,10} their responses may well reflect knowledge acquired elsewhere.

Support for this is shown by the fact that while most survey respondents indicated they had received sufficient information both about what to do if symptoms developed and about how and when to avoid contact with other people, the PHE leaflets and posters provided no information on avoidance of contact, beyond the requirement to stay indoors if symptomatic or when arriving from specified source locations. Our interview data support the survey findings that respondents believed the official information was adequate; however, their accounts show that respondents' knowledge was substantially informed by familiarity with public health interventions being taken elsewhere to contain transmission. For these passengers, the lack of visible infection control measures on arrival into the UK indicated a worrying lack of official concern about COVID-19. Their comments were verified by our researchers' observations that the design and positioning of PHE information at the arrival airport made it largely unnoticeable to arriving passengers (see Fig. 1), and by other studies highlighting a rejection of 'eye-catching measures' in the UK at the beginning of the outbreak.¹¹ Passengers' expressions of concern indicate that although the intended purpose of the leaflets was to provide information and guidance that would encourage people to follow recommended behaviours, recipients saw information provision along with other observable public health measures as an index of the adequacy of governmental outbreak response. The advice and information we evaluated thus served two roles – its intended function of public health messaging, and a reflection of the performance of official authorities. When passengers are already well informed by prior acquisition of knowledge elsewhere, as in our sample, they seem more concerned with its role as indicative of public health performance.

Our respondents highlighted their own self-discipline not only in following official advice to self-isolate when advised but also in some cases going beyond it by self-isolating as a self-initiated precautionary measure. This action was linked to perceptions of exposure risk in affected countries where travel originated or during the journey and to concerns about stigmatisation should family or colleagues subsequently become infected. Similar findings have been reported by previous studies^{13,14} indicating that travellers arriving from Ebola-affected countries restricted movement to avoid community stigmatisation. The additional interventions advocated by our respondents and their reported behaviours suggest screening people at entry, as done in 'enhanced screening' for Ebola, may help to reassure the travelling public that containment measures are in place. One recent study showed that, compared with no control, screening at entry, particularly through testing and isolating test-positive cases, can significantly reduce COVID-19 case importation numbers.¹⁵ However, these screening measures generate other difficulties such as availability of testing kits and staff,¹⁵ the length of time required to receive test results, how to maintain high sensitivity and accuracy,¹⁵ and how to accurately target passengers and avoid social stigma.^{5,16} Although quarantine for all arrivals could be another useful way to prevent the entry of infection if effective testing practices are not established, its efficacy will be affected by the length and location of quarantine, and longer duration quarantine entails a heavy burden even for resource-rich countries.^{15,17} Currently there is significant cross-national variation in the use and enforcement of testing and quarantine measures alongside public health advice at border entry, creating widespread inconsistencies and potential confusion for travellers. The UK government currently requires passengers to (voluntarily) self-isolate at home for 10 days if arriving from an affected country but this can be ended earlier if a negative COVID-19 test result is obtained.¹⁸

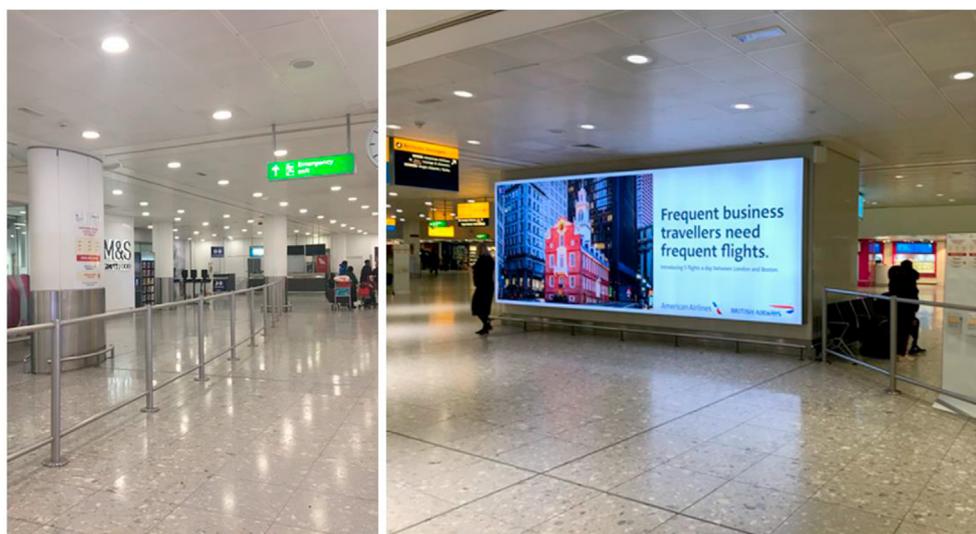


Fig. 1. Public Health England poster and leaflets, providing information and advice on COVID-19, at Terminal 3 arrivals, London Heathrow Airport in west London, 4 March 2020. Source: photos taken by researchers. Note: left, COVID-19 poster on pillar; right, COVID-19 leaflet stand (right hand side).

Our interviewees suggested various additional non-pharmaceutical interventions that were not in place on arrival, such as restricted contact tracing, temperature checks, widespread testing, and self-isolation/quarantine for all arrivals, many of which were then being used in countries such as Singapore and China and were eventually implemented in the UK.¹² This again indicates that passengers were using prior experience of pandemic control measures elsewhere to judge how seriously UK authorities were treating the

Respondents' good understanding of the information content of the PHE leaflet, which they received in flight, contrasted starkly with their reports of low visibility of, and minimal interaction with, similar materials on arrival. This suggests that providing public health information in flight, by announcements and distribution of written material – when passengers have the time to absorb it with few distractions – may be the more effective strategy. Chinese respondents commenting on PHE advice suggested that provision of

additional information and advice through departure countries or drawing on international perspectives could reassure non-citizen travellers who are not familiar with the UK healthcare system. The expressed concern of these respondents regarding mask use is vindicated by accumulating evidence and consequent changes in European policy. A recent review found a correlation between COVID-19 transmission events in flight and non-enforcement of rigid masking policy.⁴ The UK government has mandated the use of face coverings in airports and on board commercial flights since the lifting of air travel restrictions in June 2020.¹⁹ Further research is required to inform the evaluation of other potentially important strategies that could help to control infection risk and ease travel restrictions in the era of COVID-19, such as pretravel consultations that assess passengers' individual risk level and evaluate trip determinants in relation to COVID-19 policies in both origin and destination countries;²⁰ and the benefits, risks and acceptability of immunity passports that certify passengers as protected against COVID-19.^{21,22}

This study has several limitations. Because this study was conducted in the early stages of the COVID-19 outbreak, owing to the geographical focus of the outbreak at that time rapid reductions in flights, our research was limited to a small number of flights from Asia. Broader representation of respondents from different nationalities with more geographic diversity of settings since the pandemic has progressed is needed in future studies. Study size and opportunities to use our findings to inform the content and delivery of official public health guidance were limited by difficulties gaining airside airport access and obtaining cooperation from airlines, so that by the time we implemented data collection, the number of passengers arriving from affected countries had diminished drastically. Interviewees' views might have changed between survey completion on arrival and interview due to time elapsed and rapid changes in pandemic and UK policies; all interviews were completed within seven weeks from arrival date to minimise these effects. Finally, our respondents' observations regarding public health advice on arrival into the UK are inherently time-limited, in view of the rapidly changing pandemic and associated public health policy. Nonetheless, six months after the completion of our data collection, following the resumption of international travel to and from the UK, international travellers were still reporting a lack of visible public health measures or active enforcement of self-isolation regulations on arrival.

Conclusion

Our findings confirm the clarity and acceptability of public health guidance on COVID-19 provided to passengers arriving into UK ports in the early stages of the pandemic. They also demonstrate a widespread perception that information provision alone was an insufficient official response to this global public health emergency. This is cause for concern since it may reduce trust in official sources, an established driver of non-adherence to public health interventions.²³ It also indicates that public health information provision at borders should be appraised not only for its functional effectiveness in imparting guidance and encouraging behaviours to control transmission, but also for its perceived effectiveness in furnishing public assurance of official action to contain the disease threat. Travellers arriving from countries where COVID-19 was already established frequently had knowledge of the disease and of transmission containment measures not derived from official UK advice or present in the UK at that stage. In a rapidly evolving international health crisis, particularly one in which understanding of the disease is partial and changing, evaluating public understanding by reference to locally defined parameters can be unreliable, especially as

knowledge among those with experience from elsewhere may be more advanced than local understanding. This indicates the value of appraising public perceptions not only to measure understanding and adherence but also to gain insights into future potential measures and their likely acceptability. Our study also demonstrates the complexity of health policy decision-making in international public health emergencies and provides fresh insights into the need to take account of the diverse information sources on which international travellers may draw. Finally, it highlights the importance of establishing more efficient mechanisms for rapid appraisal and feedback to public health and regulatory authorities of social science evidence that could contribute to containment and control of epidemic disease threats.

Author statements

Acknowledgements

We wish to thank all participants who contributed to this study and all staff in London Heathrow Airport for their kind support. L.Y. is a NIHR Senior Investigator and partly supported by NIHR Applied Research Collaboration (ARC)-West, NIHR Health Protection Research Unit (HPRU) in Behavioural Science and Evaluation, and the NIHR Southampton Biomedical Research Centre (BRC). M.H., I.O. and H.L. are supported by the NIHR Health Protection Research Unit (HPRU) in Behavioural Science and Evaluation at the University of Bristol in partnership with Public Health England. L.S. and J.R. are supported by the NIHR HPRU in Emergency Preparedness and Response at King's College London in partnership with Public Health England. C.R. is affiliated to the National Institute for Health Research Health Protection Research Unit (NIHR HPRU) in Emerging and Zoonotic Infections at the University of Liverpool in partnership with Public Health England (PHE), in collaboration with the Liverpool School of Tropical Medicine and the University of Oxford, the NIHR HPRU in Gastrointestinal Infections at the University of Liverpool in partnership with PHE, in collaboration with the University of Warwick and the NIHR HPRU in Behavioural Science and Evaluation at the University of Bristol, in partnership with PHE.

Ethical approval

This study was a form of service evaluation and PHE's ethics committee, the PHE Research Ethics and Governance Group, confirmed that no ethical approval was required.

Funding

This study was funded by NIHR on behalf of the Department of Health and Social Care. The views expressed are those of the authors and not necessarily those of the NIHR, the Department of Health and Social Care, or PHE.

Competing interests

None declared.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2021.01.028>.

References

1. Glaesser D, Kester J, Paulose H, et al. Global travel patterns: an overview. *J Trav Med* 2017;**24**:tax007.
2. Zhong P, Guo S, Chen T. Correlation between travellers departing from Wuhan before the Spring Festival and subsequent spread of COVID-19 to all provinces in China. *J Trav Med* 2020;**27**:taaa036.
3. Wilson M, Chen L. Travellers give wings to novel coronavirus (2019-nCoV). *J Trav Med* 2020;**27**:taaa015.
4. Freedman D, Wilder-Smith A. In-flight Transmission of SARS-CoV-2: a review of the attack rates and available data on the efficacy of face masks. *J Trav Med* 2020:taaa178.
5. UK Government. *Entering the UK*. GOV. UK. 2020. <https://www.gov.uk/uk-border-control>. [Accessed 11 July 2020].
6. Keston J, Audrey S, Holding M, et al. A qualitative study of Ebola screening at ports of entry to the United Kingdom. *BMJ Glob Health* 2018;**3**:e000788.
7. Leong W. COVID-19's impact on travel medicine surpasses that of all other emerging viral diseases. *J Trav Med* 2020:taaa221.
8. Saunders B, Sim J, Kingstone T, et al. Saturation in qualitative research: exploring its conceptualization and operationalization. *Qual Quantity* 2018;**52**: 1893–907.
9. Blavatnik School of Government (BSG). *Coronavirus government response tracker*. Blavatnik School of Government, University of Oxford; 2020. <https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker>. [Accessed 6 August 2020].
10. World Health Organization (WHO). *Emergency Coronavirus disease (COVID-19) pandemic*. World Health Organization; 2020. <https://www.who.int/>. [Accessed 6 August 2020].
11. Scally G, Jacobson B, Abbasi K, et al. The UK's public health response to covid-19. *BMJ* 2020;**369**:m1932.
12. Alwan N, Bhopal R, Burgess R, et al. Evidence informing the UK's COVID-19 public health response must be transparent. *Lancet* 2020;**395**:1036–7.
13. Faherty L, Doubeni C. Unintended consequences of screening for Ebola. *Am J Publ Health* 2015;**105**:1738–9.
14. Chan J, Patel M, Tobin S, et al. Monitoring travellers from Ebola affected countries in New South Wales, Australia: what is the impact on travellers? *BMC Publ Health* 2017;**17**:113.
15. Dickens B, Koo J, Lim J, et al. Strategies at points of entry to reduce importation risk of COVID-19 cases and re-open travel. *J Trav Med* 2020:taaa141.
16. Mabey D, Flasche S, Edmunds W. Airport screening for Ebola. *BMJ* 2014;**349**: g6202.
17. Dickens B, Koo J, Wilder-Smith A, et al. Institutional, not home-based, isolation could contain the COVID-19 outbreak. *Lancet* 2020;**395**:1541–2.
18. UK Government. *Entering the UK*. GOV.UK. 2020. <https://www.gov.uk/uk-border-control/self-isolating-when-you-arrive>. [Accessed 29 December 2020].
19. UK Government. *Guidance Coronavirus (COVID-19): safer air travel for passengers*. GOV.UK. 2020. <https://www.gov.uk/guidance/coronavirus-covid-19-safer-air-travel-guidance-for-passengers#face-coverings>. [Accessed 28 December 2020].
20. Wilson M, Chen L. Re-starting travel in the era of COVID-19: preparing anew. *J Trav Med* 2020;**27**:taaa108.
21. Chen L, Freedman D, Visser L. COVID-19 immunity passport to ease travel restrictions? *J Trav Med* 2020;**27**:taaa085.
22. Imperial College London. Covid-19: global attitudes towards a COVID-19 vaccine. Report November 2020.
23. Blair R, Morse B, Tsai L. Public health and public trust: survey evidence from the Ebola Virus Disease epidemic in Liberia. *Soc Sci Med* 2017;**172**:89–97.